

## PATENT ABSTRACTS OF JAPAN

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### (54) **METAL BASE CIRCUIT BOARD AND ITS MANUFACTURE**

(57)Abstract:

PURPOSE: To provide a metal base circuit board having an excellent moisture resistance and heat radiating property and a method for manufacturing the circuit board.

CONSTITUTION: In a metal base circuit board constituted by integrally laminating metallic foil on at least one surface of a metallic substrate with an insulating layer in between, the insulating layer is formed of a heat-resistant thermoplastic resin sheet subjected to silane coupling treatment. This circuit board is manufactured in such a way that, after the heat-resistant thermoplastic resin sheet which is subjected to the silane coupling treatment by dipping the sheet in a silane coupling solution and drying is put on at least one surface of the metallic substrate, metallic foil is put on the sheet and the sheet and foil are integrally laminated. Therefore, the metal base circuit board having an excellent heat resistance and heat radiating property can be manufactured efficiently.

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CLAIMS

[Claim(s)]

[Claim 1] The metal base circuit board characterized by coming to form an insulating layer at least in one side of a metal substrate from the heat-resistant thermoplastics sheet which performed silane coupling processing in the metal base circuit board which comes to carry out the laminating unification of the metallic foil through an insulating layer.

[Claim 2] The metal base circuit board which comes to prepare the heat-resistant thermoplastics sheet which has detailed concave heights on a front face in an opposite side while preparing the heat-resistant thermoplastics sheet which performed silane coupling processing in the field in which the electronic parts of a metal substrate are carried.

[Claim 3] The manufacture approach of the metal base circuit board characterized by carrying out laminating unification after laying the heat-resistant thermoplastics sheet which was obtained by being immersed in a silane coupling solution and subsequently drying a heat-resistant thermoplastics sheet, and which performed silane coupling processing at least in one side of a metal substrate and laying a metallic foil further.

[Claim 4] The metal base circuit board according to claim 1 to 2 characterized by coming to choose heat-resistant thermoplastics out of polyether imide, a polyether ether ketone, or a polyether aphenone.

[Claim 5] The metal base circuit board according to claim 1 to 2 characterized by coming to add a high temperature conductivity filler on the heat-resistant thermoplastics sheet which performed silane coupling processing.

[Translation done.]

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## DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the good metal base circuit board and its manufacture approach of the heat dissipation nature which was equipped with the outstanding moisture resistance and was suitable for mass production.

[0002]

[Description of the Prior Art] In order to improve properties, such as heat dissipation nature, metal substrates, such as a copper plate or an aluminum plate, are used, and the metal base circuit board which established the electric conduction circuit at least in this one side through the insulating layer is known.

[0003] The sheet which consists of heat-resistant thermoplastics excellent in thermal resistance, such as polyether imide and a polyether ether ketone, as an insulating layer prepared in such the metal base circuit board is used, and there is the approach of carrying out a laminating on a metal plate.

[0004] However, in the metal base circuit board using the above-mentioned heat-resistant thermoplastics sheet, it was easy to be inferior to moisture resistance, and moisture resistance sufficient in the substrate carrying especially a semiconductor chip was required, for example, there was a problem that it could not be satisfied with the elevated temperature in a pressure cooker trial (henceforth "PCT"), high pressure, and the accelerated test under humid of demand characteristics since the insulation resistance value is low.

[0005]

[Means for Solving the Problem] The place which this invention finds out the metal base circuit board which can cancel the above-mentioned trouble, and its manufacture approach, and is made into the summary In the metal base circuit board which comes to carry out the laminating unification of the metallic foil at least at one side of a metal substrate through an insulating layer The metal base circuit board characterized by coming to form an insulating layer from the heat-resistant thermoplastics sheet which performed silane coupling processing, and a heat-resistant thermoplastics sheet are immersed in a silane coupling solution. Subsequently It is in the manufacture approach of the metal base circuit board characterized by carrying out laminating unification, after laying the heat-resistant thermoplastics sheet which was obtained by drying and which performed silane coupling processing at least in one side of a metal substrate and laying a metallic foil further.

[0006] The copper plate excellent in heat dissipation nature, an aluminum plate, a griddle, etc. can be used for the metal substrate used by the metal base circuit board of this invention, and the thing of the range of 0.5-1.5mm can use thickness suitably preferably 0.15-5.0mm.

[0007] Although a metallic foil is prepared at least in one side of the above-mentioned metal substrate through an insulating layer As resin which needs to form from the heat-resistant thermoplastics sheet which performed silane coupling processing as this insulating layer in the substrate of this invention, and is used In the substrate of which polyether imide, a polyether ether ketone, a polyether ape phon, etc. can use it suitably, and heat dissipation nature is further required by altitude The mixture of the above-mentioned resin and high temperature conductivity fillers, such as silicon nitride excellent in

thermal conductivity, aluminum nitride, and boron nitride, can use it suitably. Although the addition of a filler changes with demand quality, 50 % of the weight - about 70 % of the weight is desirable.

[0008] The thickness of a sheet should just make preferably 500 micrometers [ 20 micrometers - ] of shaping of the sheet which consists of the above-mentioned resin the range of 50micro - 150 micrometers from the point of insulating and thermally conductive that what is necessary is just to sheet-ize by the usual extrusion-molding method etc.

[0009] It is necessary to perform silane coupling processing to the above-mentioned sheet, and moisture resistance can be improved in this invention. Although there are various approaches among the approaches of silane coupling processing, the approach of points, such as effectiveness, to a degree is desirable. First, the above-mentioned heat-resistant thermoplastics sheet is immersed in a silane coupling solution. The approach continuously immersed in a solution in the whole sheet as the approach of immersion has good effectiveness, as a silane coupling solution, what diluted the undiluted solution of a silane coupling agent with the ethanol solution (about 90% of concentration) can use it suitably, and immersion time amount has for [ 1 minute ] - a good 2-minute about room. In addition, dehumidifying processing may be carried out beforehand at the sheet before immersion.

[0010] After immersion, after leaving a sheet in atmospheric air, being air-dry and losing a liquid lappet, it is made to dry in oven etc. and an unnecessary solution is vaporized from a sheet. It considers as desiccation conditions and the drying temperature of 150 degrees C and about drying-time 1 hour are desirable.

[0011] After laying the heat-resistant thermoplastics sheet which performed silane coupling processing obtained by the above-mentioned approach at least in one side of a metal substrate and laying a metallic foil further, the metal base circuit board is obtained by carrying out laminating unification. What is necessary is to just be based on the usual hot press method as an approach of carrying out laminating unification.

[0012] Although the above-mentioned heat-resistant thermoplastics sheet is prepared at least in one side of a metal substrate, while preparing the heat-resistant thermoplastics sheet concerned in the field in which electronic parts are carried, in the case of a semi-conductor packaging application, the metal base circuit board which prepared the heat-resistant thermoplastics sheet which has detailed concave heights on a front face in the opposite side has the advantage that adhesion with closure resin is improvable.

[0013] Hereafter, an example explains this invention.

[0014]

[Example] The heat-resistant thermoplastics sheet (they are 60-% of the weight mixing and the thickness of 100 micrometers about aluminum nitride impalpable powder to a polyether ether ketone) sheet-ized by the extrusion-molding method was used. This sheet was immediately immersed in the silane coupling solution. 200ml of Nippon Unicar silane coupling agents Y-9669 was used for the silane coupling solution, they were diluted by 800ml (90% of concentration) of ethanol solutions, and it adjusted them. After being immersed in the above-mentioned solution for [ for / 1 minute / - ] 2 minutes, it left and was air-dry in atmospheric air, and dried in oven after that for 150 degree-Cx 1 hour. Subsequently, the obtained sheet was laid in one side of a metal substrate (a copper plate, thickness of 0.5mm), and copper foil with a thickness of 12 micrometers was laid further, and the sheet (thickness of 50 micrometers) which consists only of a polyether ether ketone which has detailed concave heights on a front face was laid in the opposite side of a metal substrate, and laminating unification was carried out.

[0015] Hot press conditions -- PCT was carried out using 400 degree-Cx50 kgf/cm<sup>2</sup> and the metal base circuit board obtained for 30 minutes. Conditions: 125 degrees C, 2.3 atmospheric pressures, 100%RH (partial saturation), 300 hours.

[0016] When the insulation resistance between a metal substrate and copper foil was measured, it is 108-109. It was as good as omega. On the other hand, insulation resistance is 106, when the substrate was obtained with the same configuration as the above-mentioned substrate except having used the sheet which is not in \*\*\*\* about silane coupling processing as an example of a comparison and same PCT was carried out. It was inferior with omega and there was a problem practically.

[0017]

[Effect of the Invention] As mentioned above, there is an advantage that have the outstanding moisture resistance according to this invention, and the good metal base circuit board of heat dissipation nature is obtained, and such a substrate is obtained efficiently.

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**TECHNICAL FIELD**

[Industrial Application] This invention relates to the good metal base circuit board and its manufacture approach of the heat dissipation nature which was equipped with the outstanding moisture resistance and was suitable for mass production.

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**EFFECT OF THE INVENTION**

[Effect of the Invention] As mentioned above, there is an advantage that have the outstanding moisture resistance according to this invention, and the good metal base circuit board of heat dissipation nature is obtained, and such a substrate is obtained efficiently.

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(54)【発明の名称】 金属ベース回路基板及びその製造方法

(57)【要約】

【目的】 優れた耐湿性を備え、放熱性の良好な金属ベース回路基板及びその製造方法を提供する。

【構成】 金属基板の少なくとも片面に、絶縁層を介して金属箔を積層一体化してなる金属ベース回路基板において、絶縁層をシランカップリング処理を施した耐熱性熱可塑性樹脂シートから形成してなることを特徴とする金属ベース回路基板及び、耐熱性熱可塑性樹脂シートをシランカップリング溶液に浸漬し、ついで、乾燥して得られた、シランカップリング処理を施した耐熱性熱可塑性樹脂シートを金属基板の少なくとも片面に載置し、更に金属箔を載置した後、積層一体化することを特徴とする金属ベース回路基板の製造方法。

【効果】 優れた耐湿性を備え、放熱性の良好な金属ベース回路基板が得られ、またこのような基板が効率的に得られるという利点がある。

## 【特許請求の範囲】

【請求項1】 金属基板の少なくとも片面に、絶縁層を介して金属箔を積層一体化してなる金属ベース回路基板において、絶縁層をシランカップリング処理を施した耐熱性熱可塑性樹脂シートから形成してなることを特徴とする金属ベース回路基板。

【請求項2】 金属基板の電子部品を搭載する面にシランカップリング処理を施した耐熱性熱可塑性樹脂シートを設けるとともに、反対面に微細な凹凸部を表面に有する耐熱性熱可塑性樹脂シートを設けてなる金属ベース回路基板。

【請求項3】 耐熱性熱可塑性樹脂シートをシランカップリング溶液に浸漬し、ついで、乾燥して得られた、シランカップリング処理を施した耐熱性熱可塑性樹脂シートを金属基板の少なくとも片面に載置し、更に金属箔を載置した後、積層一体化することを特徴とする金属ベース回路基板の製造方法。

【請求項4】 耐熱性熱可塑性樹脂がポリエーテルイミド、ポリエーテルエーテルケトン又はポリエーテルサルフォンから選ばれてなることを特徴とする請求項1乃至請求項2記載の金属ベース回路基板。

【請求項5】 シランカップリング処理を施した耐熱性熱可塑性樹脂シートに高熱伝導性フィラーを添加してなることを特徴とする請求項1乃至請求項2記載の金属ベース回路基板。

## 【発明の詳細な説明】

## 【0001】

【産業上の利用分野】 本発明は優れた耐湿性を備え、かつ量産に適した、放熱性の良好な金属ベース回路基板及びその製造方法に関する。

## 【0002】

【従来技術及びその課題】 放熱性等の特性を改良するために銅板またはアルミニウム板等の金属基板を使用し、この少なくとも片面に絶縁層を介して導電回路を設けた金属ベース回路基板が知られている。

【0003】 このような金属ベース回路基板に設ける絶縁層として、耐熱性に優れたポリエーテルイミドやポリエーテルエーテルケトン等の耐熱性熱可塑性樹脂からなるシートを使用し、金属板上に積層する方法がある。

【0004】 しかしながら、上記耐熱性熱可塑性樹脂シートを用いた金属ベース回路基板では耐湿性に劣り易く、特に半導体チップを搭載する基板では十分な耐湿性が要求され、例えばプレッシャークッカー試験（以下、「PCT」という）における高温、高圧、多湿下での促進試験で絶縁抵抗値が低いために、要求特性を満足できないという問題があった。

## 【0005】

【課題を解決するための手段】 本発明は上記問題点を解消できる金属ベース回路基板及びその製造方法を見出したものであって、その要旨とするところは、金属基板

の少なくとも片面に、絶縁層を介して金属箔を積層一体化してなる金属ベース回路基板において、絶縁層をシランカップリング処理を施した耐熱性熱可塑性樹脂シートから形成してなることを特徴とする金属ベース回路基板及び、耐熱性熱可塑性樹脂シートをシランカップリング溶液に浸漬し、ついで、乾燥して得られた、シランカップリング処理を施した耐熱性熱可塑性樹脂シートを金属基板の少なくとも片面に載置し、更に金属箔を載置した後、積層一体化することを特徴とする金属ベース回路基板の製造方法にある。

【0006】 本発明の金属ベース回路基板で使用する金属基板には放熱性に優れた銅板、アルミニウム板、鉄板等が使用でき、厚みは0.15～5.0mm、好ましくは0.5～1.5mmの範囲のものが好適に使用できる。

【0007】 上記金属基板の少なくとも片面には絶縁層を介して金属箔を設けるが、本発明の基板では該絶縁層としてシランカップリング処理を施した耐熱性熱可塑性樹脂シートから形成する必要がある、使用する樹脂としては、ポリエーテルイミド、ポリエーテルエーテルケトン、ポリエーテルサルフォン等が好適に使用でき、さらに高度に放熱性を要求される基板では、上記樹脂と熱伝導性に優れた窒化ケイ素、窒化アルミニウム、窒化ホウ素等の高熱伝導性フィラーとの混合物が好適に使用できる。フィラーの添加量は要求品質により異なるが、50重量%～70重量%程度が好ましい。

【0008】 上記樹脂からなるシートの成形は通常の押出し成形法等によりシート化すればよく、シートの厚みは絶縁性と熱伝導性の点から20μm～500μm、好ましくは50μm～150μmの範囲とすればよい。

【0009】 本発明では上記シートにシランカップリング処理を施す必要がある、耐湿性を改良できる。シランカップリング処理の方法には種々の方法があるが、効率等の点から次の方法が好ましい。まず、上記の耐熱性熱可塑性樹脂シートをシランカップリング溶液に浸漬する。浸漬の方法としてはシート全体を連続して溶液に浸漬する方法が効率がよく、シランカップリング溶液としては、シランカップリング剤の原液をエタノール溶液（濃度90%程度）で希釈したものが好適に使用でき、浸漬時間は1分間～2分間程度がよい。なお、浸漬前のシートに前もって脱湿処理してもよい。

【0010】 浸漬後、シートを大気中に放置し風乾して液垂れを無くしてからオープン等で乾燥させ不要な溶液をシートから揮散させる。乾燥条件とし乾燥温度150℃、乾燥時間1時間程度が好ましい。

【0011】 上記方法により得られたシランカップリング処理を施した耐熱性熱可塑性樹脂シートを金属基板の少なくとも片面に載置し、更に金属箔を載置した後、積層一体化することにより金属ベース回路基板が得られる。積層一体化する方法としては、通常の加熱プレス法

によればよい。

【0012】上記耐熱性熱可塑性樹脂シートは金属基板の少なくとも片面に設けるが、電子部品を搭載する面に当該耐熱性熱可塑性樹脂シートを設けるとともに、反対面に微細な凹凸部を表面に有する耐熱性熱可塑性樹脂シートを設けた金属ベース回路基板は半導体パッケージング用途の場合、封止樹脂との密着性が改良できるという利点がある。

【0013】以下、本発明を実施例により説明する。

【0014】

【実施例】押出し成形法によりシート化した耐熱性熱可塑性樹脂シート（ポリエーテルエーテルケトンに窒化アルミニウム微粉末を60重量%混合、厚み100 $\mu$ m）を用いた。直ちにこのシートをシランカップリング溶液に浸漬した。シランカップリング溶液は、日本ユニカー（株）製シランカップリング剤Y-9669を200ml使用し、エタノール溶液（濃度90%）800mlにより希釈して調整した。上記溶液に1分間～2分間浸漬した後、大気中に放置、風乾し、その後オープンで150℃×1時間乾燥した。ついで、得られたシートを金属

み12 $\mu$ mの銅箔を載置し、また金属基板の反対面には微細な凹凸部を表面に有するポリエーテルエーテルケトンのみからなるシート（厚み50 $\mu$ m）を載置し積層一体化した。

【0015】加熱プレス条件…400℃×50kgf/cm<sup>2</sup>、30分

得られた金属ベース回路基板を用いて、PCTを実施した。条件：125℃、2.3気圧、100%RH（不飽和）、300時間。

10 【0016】金属基板と銅箔間の絶縁抵抗を測定したところ10<sup>8</sup>～10<sup>9</sup>Ωと良好であった。これに対し比較例としてシランカップリング処理を施さないシートを用いた以外は上記基板と同一構成で基板を得、同様のPCTを実施したところ、絶縁抵抗は10<sup>6</sup>Ωと劣り、実用上問題があった。

【0017】

【発明の効果】上述したように、本発明によれば優れた耐湿性を備え、放熱性の良好な金属ベース回路基板が得られ、またこのような基板が効率的に得られるという利点がある。